

## DYNAMIC ANALYSIS AND SIMULATIONS OF A BACKHOE

**Shahriar Ahmadi Ghooohaki** (Tamar Wasfy), Department of Mechanical Engineering, Purdue School of Engineering and Technology, Indianapolis, Indiana 46202

A backhoe is a type of excavating equipment that is used in most digging processes in the construction industry. Increasing the speed of digging, the load capacity and the stability of the vehicle during the digging operation are required in order to reduce the backhoe operating costs. The overall objective of this project is to develop a high-fidelity flexible multibody dynamic model of the backhoe by using Pro/Engineer and a finite element multibody dynamics code called DIS. Pro/Engineer is used to create the geometry of the major moving components of the backhoe including undercarriage, road wheels, idler pulleys, drive sprocket, track, main body, boom, stick, bucket and hydraulic actuators. The components of the backhoe are imported to DIS and connected using joints including spherical, revolute and prismatic joints. In addition, contact surfaces for the wheels, sprocket, track segments and bucket are defined. A discrete element model (DEM) for the sand that is excavated by the backhoe is used. In the DEM model sand is modeled using discrete particles with appropriate normal, tangential friction and adhesion contact force models. The model can be used to predict the digging force exerted by the hydraulic actuators. This in turn can be used to predict the allowable digging speed and load capacity. The model can also be used to predict the stability of the backhoe during digging.